University Lowbrow Astronomers
Ann Arbor, Michigan

REFLECTIONS / REFRACTIONS

University Lowbrow Astronomers

Volume 30, Issue 1

January 2006

My first Telescope by Ken Cook

I am a relative newcomer to the Lowbrow's having only been involved for 2 years. A new telescope prompted me to seek out those more knowledgeable than myself about these fascinating devices – but that is another article.

The first telescope I remember using was my Dad's telescope. In the late 1960's he built a telescope. It was a 4" f/10 Newtonian reflector made from a carpet tube on a steel and galvanized pipe stand. A friend of his welded the tripod. The mount was an alt-azimuth design built from galvanized steel pipe. Scope rings were made from particleboard and pipe straps. The counter weight was a lead packaging shield from a radioisotope source (He used to work in nuclear physics). An army surplus tank sight was the finder. A simple friction fit focuser worked fine – just push and pull until the image is in focus. The spider was a single wire from the focuser mounting plate to the secondary mirror. Just bend the wire to collimate; my dad turned a few of his own eyepieces, all this work from the excitement of the Apollo space program. I saw the craters and mountains of the Moon. The shadows were the most stunning things to see. I also saw the central bands on Jupiter, the Galilean moons, and little tiny Saturn. We observed these in spite of the mercury vapor street light in the front yard of my parents' house.

My Dad observed more than I did. I was only five when we landed on the moon, but I remember it well. It was a major theme for my friends and me.

I did not pursue astronomy as a hobby. Space was always fascinating but observing was not on my list of hobbies, until Hale-Bopp. Comet Hale-Bopp (C1995/O1) prompted me to look into the night sky more. As I held my toddler daughter and pointed at the sky saying "See the fuzzy star?" I realized that I didn't have a telescope. My binoculars were probably my best choice given the mercury vapor street light in my front yard (I detect a theme here). I was lamenting my lack of observing apparatus when my wife noticed a Tasco 60mm refractor on QVC with a 1-month money back guarantee if we didn't like it, so we bought it. My first scope! Poor little device that it was: terrible chromatic aberration, awful eyepieces, wobbly mount, poor altitude adjustment and no azimuth adjustment. But I could see the moon, and sort of see Hale-Bopp (not quite). I could see Jupiter and its central bands, and I could see Saturn. And the Galilean moons which changed every night.

I could quickly tell the cheap little Tasco scope was not going to suffice, so I asked my Dad if he still had his 4" Newtonian reflector, which he did.

So I now had a small aperture reflector to use. There were a few problems: the mirror was very dusty and the wood supports for the finder scope had broken. So I didn't have a finder. The counter weight is a square-ish block of lead on a hollow square tube. I was able to sight through the hollow tube on really bright objects to almost line up the scope.

This scope occupied me for about 1 year, I upgraded to other scopes but still have that old one my father made. It awaits a good rebuilding effort.

Inside this issue:

Ken Cook

Important Club Info

- January 20, 2006 at 7:30pm Monthly meeting room 130 Dennison Hall.
- January 28, 2006 at dusk Public Open House, Peach Mt. Observatory
- February 4, 2006 at dusk Public Open House, Peach Mt. Observatory
- February 17, 2006 at 7:30pm Monthly meeting room 130 Dennison Hall.

Gravity, Part 1: What Einstein Did For Astronomy

by Dave Snyder

The College of Literature Science and the Arts (LS&A for short) recently instituted "theme semesters." For Fall 2005, the theme was "100 Years Beyond Einstein" (2005 is the hundredth anniversary of Einstein's miraculous year, which I'll explain below). There were classes, lectures and other events connected with Einstein. One of the lectures, "What Astronomy Has Done For Einstein," was given by Dr. Joceyln Bell-Burnell.

Joceyln Bell-Burnell was born Susan Jocelyn Bell. Her PhD work involved a then recently discovered class of objects known as quasars. In the late 60's she and her advisor Antony Hewish used radio telescopes to study quasars. She noticed some signals that repeated with a regular pattern, but no one knew how they were generated.

As a joke, the signals were given the label "Little Green Man 1" (since no one knew what they were, perhaps they were from extra-terrestrials). Soon it was realized it could be explained by a natural process: a new type of object, called a pulsar, was responsible.

Shortly after this discovery she married Martin Burnell, and now uses the name Joceyln Bell-Burnell.

In 1974, Hewish along with Sir Martin Ryle, were awarded the Nobel Prize in Physics in part because of the role Hewish played in the discovery of pulsars. Many people (myself included) believe that Bell-Burnell should have been included in the 1974 award. Nevertheless, Bell-Burnell has received many other awards including the the Michelson Medal of the Franklin Institute.

Dr. Bell-Burnell began her talk with Einstein. Einstein was born in Germany in 1879, but renounced his German citizenship in 1896. He graduated from a Swiss university in the year 1900. He was a man without a country until 1901 when he was granted Swiss citizenship. He had trouble getting a job, but found a position at the Patent Office in Bern, Switzerland. He worked there for several years including the miraculous year 1905. That year Einstein wrote five papers. In chronological order:

- "A New Determination of Molecular Dimensions."
- "On a Heuristic Point of View Concerning the Production and Transformation of Light."
- "On the Motion of Small Particles Suspended in Liquids at Rest Required by the Molecular-Kinetic Theory of Heat."
- "On the Electrodynamics of Moving Bodies."
- "Does the Inertia of a Body Depend on its Energy Content?"

(Ok, I just lied, there actually was a sixth paper, but it really was just an elaboration of earlier work).

Before I continue, I must make an important distinction. "The Theory of Relativity" is really two different theories: Special Relativity and General Relativity. Special Relativity was developed during 1905; it is covered in part in "On the Electrodynamics..." and in part in "Does the Inertia of a Body...." The later paper, in three short pages, has all of the thinking necessary to derive $E=mc^2$, however the equation itself did not appear in print until later. Ten years later Einstein developed a different theory called General Relativity. I'll get to General Relativity in a moment.

"A New Determination..." and "On the Motion..." deal with atoms and molecules. Before these papers there was some doubt about the existence of atoms, after these papers were published and accepted there was no doubt. "A New Determination..." was submitted to the University of Zurich and Einstein was granted a PhD based on that paper.

Some years earlier experimenters noticed that light shining on metal often created an electric current, this became known as the photoelectric effect; but a theory that completely explained it did not exist until "On a Heuristic Point of View..." appeared. Before that paper, physicists believed that light propagated as waves. This paper shows that light propagates as particles. (Einstein initially referred to these particles by the term "quanta of light," but we now call these particles "photons." A hundred years later, our understanding of light is more complicated, light is neither a particle nor a wave, but it sometimes behaves like a particle and sometimes it behaves like a wave).

The rest of the talk has nothing to do with these papers.

Special Relativity only describes objects moving in a straight line with constant velocity. Einstein knew that Special Relativity was incomplete.

Einstein returned to Germany in 1914, but did not reapply for German citizenship. He accepted a research position at the University of Berlin. At the time, the best theory of gravity was based on Newton's laws. But Einstein had problems with it. Over the next couple years, he developed General Relativity, his theory of gravity. General Relativity makes predictions that are similar to Newton's equations, but there are slight differences. It also involves mathematics that is more complicated than either Newton's equations or any of Einstein's 1905 work. Many of the equations of Special Relativity involve simple algebra, this is not true of General Relativity.

This work was finally published in 1916. While the 1905 work was a major accomplishment, other scientists probably could have replicated it if Einstein hadn't done the work first. It is hard to imagine who would have invented General Relativity if Einstein hadn't.

1916 was the middle of World War I; Britain was on one side and Germany was on the other. Most British hated the Germans and everything associated with Germany. Dr. Bell-Burnell gave several examples of how this hatred expressed itself, such as the vandalism of stores with German names.

One English astronomer, Arthur Eddington, didn't participate in this hatred. Eddington was the Secretary of the Royal Astronomical Society and part of his responsibilities was evaluating incoming papers to be published. Einstein's work on General Relativity was one of these papers. The paper was clearly identified with the University of Berlin, other scientists would have seen such a paper and discarded it along with anything else German. Eddington did not discard the paper, he read it and after he grasped the theory, he explained it to other astronomers and to the general public. Eddington was well respected and good at communicating. Without Eddington's help, it would have been much longer before Einstein's ideas gained recognition.

Eddington also helped verify the conclusions of the theory. Newton's laws predicted that path of light from a star would be bent by the gravity of the sun by about 1.75 seconds of arc (the angle will vary depending on the exact situation). General Relativity also predicts bending, but the amount is exactly twice as large (by about 3.50 seconds of arc). Eddington thought that a solar eclipse would be the easiest way to measure the bending and verify the theory (normally glare from the sun makes this measurement impossible, during a solar eclipse the sun's light is blocked and light from nearby stars can be seen and measured).

There would be an eclipse of the sun in 1919; at the time of the eclipse, the sun would be in the Hyades. If you take a photograph of the Hyades before the eclipse, and another during the eclipse, there should be a shift in the positions of the stars due to the Sun's gravity. They planned an expedition to observe the eclipse, but World War I was still going on which made preparations difficult. Fortunately the war ended in late 1918, even so it was a difficult experiment. The eclipse path started in Brazil, passed over the South Atlantic and ended in West Africa. Making these measurements from a ship is almost impossible (and was not attempted), both Brazil and West Africa are frequently cloudy and there were problems with the telescopes.

In spite of the problems, the experiment was conducted and the results confirmed Einstein's equations. It attracted a lot of public attention, perhaps because the public was tired of war, and eagerly wanted something else to talk about. There were headlines in the New York Times and other publications. Einstein soon become well known: There was a joke that only three people understood General Relativity (this was never true, but that doesn't stop ideas like this from spreading). Someone asked Eddington about this. After the initial question, the exchange went something like this

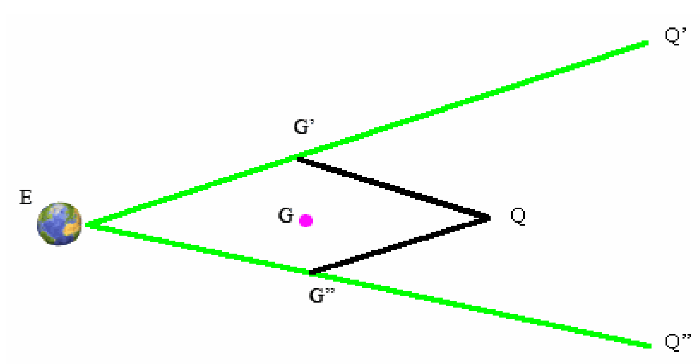
Eddington: Oh Dear Me!

Questioner: Don't be modest Eddington!

Eddington: I'm not being modest, I'm trying to think who the third person is.

Einstein was awarded the Nobel Prize in Physics in 1921. The Nobel committee specifically stated that the award was not for his work on relativity since it was "an unproven idea," rather the award was given for his work on the photoelectric effect. Einstein was born in Germany but was a swiss citizen; he did part of his work in Switzerland and part in Germany. This created a diplomatic problem as both countries wanted to claim Einstein as a Nobel Laureate. Dr. Bell-Burnell did not know how this problem was resolved.

There have a number of applications of General Relativity. In 1979 radio astronomers discovered a pair of quasars with identical properties but 6 arc seconds apart. Before General Relativity, this was difficult to explain. However suppose there is just one quasar, and there is a galaxy located between the earth and the quasar.



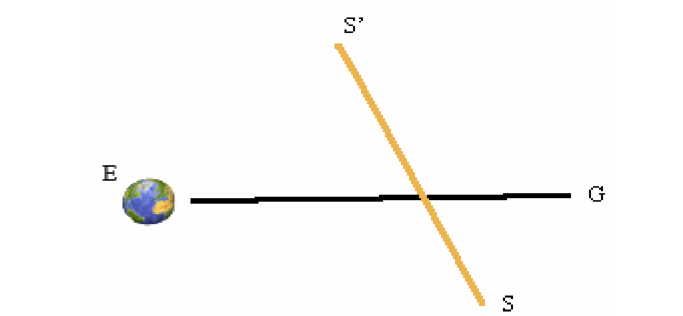
In at the diagram above, the galaxy is marked G, the earth is marked E and the quasar is marked Q.

Light from the quasar is bent by the galaxy: it travels from Q to G' to E and it travels Q to G" to E. An earth-bound observer would see what appears to be two identical quasars, one at Q' and the other at Q".

This bending can also create structures called Einstein Rings and called Einstein Crosses. This behavior is similar to what happens when a lens bends light, so the object in the middle is called the lensing object. The lensing object might be a star, a galaxy or even a cluster of galaxies. Typically light is bent by an angle of 1 second for a single galaxy, and 30 seconds for clusters of galaxies. By observing double quasars, rings or crosses, and assuming General Relativity is correct, it is possible to figure out how much mass the lensing object has.

We can estimate the total mass of a lensing object from the angle. If you estimate the mass of a galaxy and compare this to the observed velocities of stars within the galaxy, the velocities are too fast and the galaxy should fly apart. They do not; we now believe material called "dark matter" prevents this. By studying the lensing effect from galaxies and clusters of galaxies, we are able to determine the mass of these objects and in turn how much dark matter is present.

When a small object is directly between us and a galaxy, it can cause lensing. We call this microlensing.



In the diagram above, light from a galaxy (G) travels to the Earth (E). Nearby a dim star is moving from (S) to (S'). (The diagram is not to scale, the star is much closer to the Earth than the galaxy is). When the star is between the Earth and the galaxy, the light is bent slightly and the amount of bending changes as the star moves. By carefully measuring the light from many objects, we can detect the presence of stars or other objects too dim to observe in other ways. We've seen a lot of these events. In a few cases we see not just a hidden star, but something smaller as well. No one is certain, but the smaller objects just might be planets.

Another example is the orbit of Mercury. Mercury travels in an ellipse around the sun. However it isn't a perfect ellipse, the other planets, particularly Jupiter, perturb the orbit and it precesses. In the late 1800's astronomers worked out how much precession should be present, there was 43 arc seconds a year more precession than could be accounted for. Even though the effect was tiny, it bothered astronomers. The favored explanation was a hidden planet, which became known as Vulcan, resulted in extra precession. There isn't room to explain the details here, but after General Relativity was described, it was realized that General Relativity predicts more precession than Newton's equations do, exactly the amount to account for Mercury's orbit. Vulcan was no longer necessary.

This precession effect is larger for binary pulsars, Dr. Bell-Burnell gave two examples, one with a precession of 4.2 degrees a year and the other with a precession of 17 degrees a year. In both cases the entire precession was due to General Relativity. While textbooks typically use Mercury's orbit as an example, she suggested that pulsars might be a better example to use when teaching physics students.

Another example is gravitational waves. Einstein predicted that an object under acceleration will emit waves, which we now call gravitational waves. Unfortunately we've never observed these waves directly (there are some projects that may eventually detect these waves, but they are a few years off).

That doesn't mean there is no evidence for gravitational waves. Suppose we have two stars in orbit. Accelerating objects, such as orbiting stars, emit gravitational waves. When a star emits a gravitational wave, it losses energy and thus losses mass. Kepler's laws suggest that as stars lose mass, they must move toward each other and speed up. Then they emit more gravitational waves and speed up.

This has been observed. Some astronomers had monitored a binary pulsar for thirty years. The orbit was getting smaller and the velocities increasing in exactly way that General Relativity predicts it should.

That's enough for now; I plan in a future article to discuss other aspects of gravity.

While most of the material for this article came Dr. Bell-Burnell's talk, I also used the following book:

______. 1998. *Einstein's Miraculous Year: Five Papers That Changed the Face of Physics*. John Stachel editor. Princeton University of Press: Princeton, New Jersey.

It contains new translations of all five papers I mentioned earlier.

Mark S Deprest—Interim Editor

University Lowbrow Astronomers

Astronomical League

Association of Lunar & Planetary Observers

American Association of Amateur Astronomers

A.L. Comet Observers' Club Gold Award Recipient

The New Newsletter: An Editorial

I like to say thank you to John and Tom Ryan for their efforts over the past couple of years, having been the newsletter editor in the past, I am very aware of the amount of work that goes into each issue that gets published. The University Lowbrow Astronomers owe a big thank you to both of them.

But, all good things must come to an end eventually, and when Charlie Nielsen asked if someone could step up and help out as the interim editor, I took a long hard look at whether I could fit this task into my schedule or not. I always loved doing the job before, and the many contributors that sent me articles always seemed to come through in the past. I wanted to be sure I could do the job and give it the commitment that it needs to produce the high quality newsletter the club is use to getting and deserves to continue to receive. After some discussions with Charlie and a little schedule shuffling, I found the time and commitment to be available.

I want to let the entire membership of the University Lowbrow Astronomers know, that I have given my word to that I will perform the duties of Newsletter Editor as outlined in the By-Laws, and I have further agreed to run for the position in April 2006 and April 2007. That's right my commitment is to serve as Newsletter Editor for two terms, as well as serving as Interim Editor for the remainder of the current term. I have further promised to produce a newsletter suitable for printing and web posting by the 7th of each month and I fully intend on fulfilling that promise, so you all had better get writing now! If you have written and article in the past, thank you! but this doesn't get you off my list (I now know that you can write) and if you haven't written anything in the past, then you need to hold up your end in this club! (no one said this was a free ride!) I want to see an article from everyone and don't give me this stuff about, "I can't write anything, that anyone would want to read …" Look at some of the garbage that appears in your local paper everyday, I know you can do better than that! Sorry, I see that soapbox out and I just can't help steppin' on up!

Seriously, I want everyone to contribute to this newsletter, I was always so proud of it in the past, I use to boast to other clubs and show it off as a kind of "a in your face" look what my club can accomplish on a month basis! And you all made that possible.

So for those of you who are still sitting there thinking, "I don't know what to write about," here are a few ideas for articles. Ask yourself, how did I get into astronomy? Or, what was your first exposure to this hobby? Then when you think of the answer write it down, (hint write it in your own words, you know, the way you talk everyday) it doesn't have to be five pages long, it doesn't even have to be one page long, but I know darn well that it will be at least a two paragraph answer, and that my friends is an article!

I have some crack professional reporters on staff or was that a staff of amateur reporters on crack, oh whatever, lets just say that these people owe me big time and they will, from time to time, appear as writers for this Newsletter, however I have agreed not to use their real names, so watch for them as the year progresses.

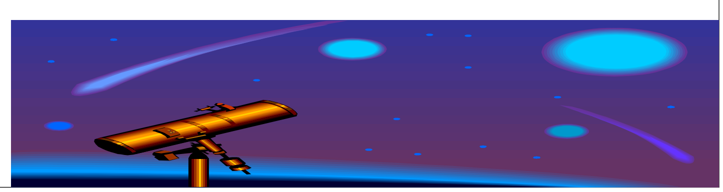
I want to thank the officers for their vote of confidence in me (not like anyone else was going to step up and do this job) and I promise that I won't let you down! As Charlie so eloquently put it, "Mark is back!!!" so, you better get writing because there is no place to hide and I don't take prisoners, just articles and pictures!

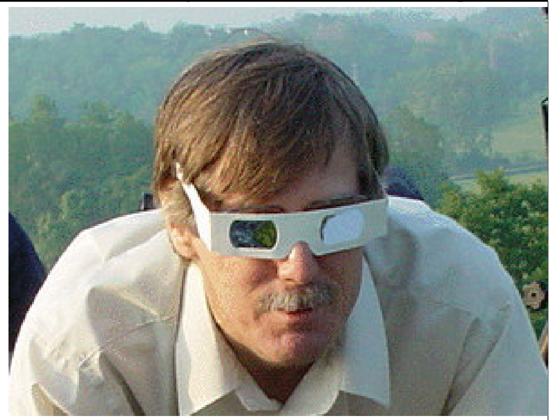
Interim Newsletter Editor

Mark S Deprest

Lowbrows at the February 2005 Open House … now these guys are really committed to the hobby, and shortly after this photo was taken the men in the "white-coats" came and took them all away and really had them committed!

I'm happy to say that the treatment worked and they have all rejoined society and are semi-productive members now!





Chris Sarnecki using his special Planetary Nebula glasses—Wow, those are cool!

Planetary Primer

By Christopher Sarnecki

No Fear - Science tells us planetary nebulae are expanded shells of glowing gas shed by low mass stars moving in to their declining years. To beginning and intermediate observers, planetary nebulae are those pesky smallish orbs that are to be avoided with the exception of a few of the most brightest and easily found planetaries. The big and bright planetaries that we all are familiar are the four Messier planetaries M27, M57, M76, and M97. We are comfortable with these objects because; well, that is the way we are brought up to observe. Granted the four Messier planetaries are somewhat large and bright; but, as we will see, other New General Catalog (NGC) planetaries are also worthy of our attention. In this article, planetary nebulae will be listed, for your viewing convenience, as indicated below starting with the four Messier planetaries. Note the magnitude and size of the listed planetary. This is where we will gain the confidence to move on to NGC planetary observing.

Catalog No.	Mag	Size	Coordinates - RA/Dec	Common Name	Remarks
M27	7.3	8' x 4'	19hx59.6m/+22^43'	Dumbbell Nebula	BIG & BRIGHT
M57	8.8	86"x63"	18h53.6m/+33^02'	Ring Nebula	less big & bright
M76	10.1	67"	01h42.4m/+51^34'	Little Dumbbell	smaller, fainter
M97	9.7	2.8'	11h14.8m/+55^01'	Owl Nebula	*

* - Preachy Note - Again note the magnitude and size when observing planetaries.

Getting Started - Most of us use illuminated reticule finders such as a *Rigel* or *Telrad*, for general observing. When hunting down planetary Nebulae, it helps to use a finder scope to zero in on the planetary star field after using your illuminated reticule finder to find the general target area. I use an 8 x 52-mm right-angle, correct image finder scope. A straight through finder scope is also helpful. Without use of a finder scope, locating a smallish fainter planetary is probably going to be a chance occurrence. With a finder scope, you are pretty much guaranteed to locate the correct star field. I like the right-angle, correct image finder scope for a couple of reasons. The right angle finder scope eyepiece lets me get my head (and eye) in an easy position that straight through finder scopes don't; and, the image seen in the correct image finder scope matches that of my star chart. Next get a decent star chart. I use Star Atlas 2000 by Wil Tirion and Roger Sinnott. You can use any star chart of your choosing, but you are going to need a star chart. Plan a short list of planetaries that are expected to be up during your observing run. Because this article is written in the summer, let's assemble a short list of some easy Summer NGC planetaries.

Catalog No.	Mag	Size	Coordinates - RA/Dec	Common Name	Remarks
NGC 6543	8.1	22"x19"	17h58.6m/+66^38'	Cat's Eye Nebula	> Bright as M57
NGC 6572	8.1	11"	18h12.1m/+06^51'	Green Nebula **	> Bright as M57
NGC 6826	8.8	28"x25"	19h44.8'/+50^32'	Blinking Planetary	>Bright as M57
NGC 6818	9.3	22"x15"	19h44.0m/_14^09'	Little Gem	< Bright as M97
NGC 7009	8.3	28"	21H04.2M/-11^22'	Saturn Nebula	> Bright as M57

** - Nicknamed by Lowbrows just after observing it. Catalogs indicate as Emerald Nebula, Blue Racquetball, Turquoise Orb.

The listed planetaries above are not at large as M57, but are with the exception of the Little Gem, they are as bright as or slightly brighter than M57. Smaller and brighter planetaries will have a brighter per arc-second area when compared to an object such as M57. This means these objects are going to appear brighter, and perhaps easier to find. This should give you the confidence to move on to more challenging planetaries.

Intermission - Wisconsin Micro Brews, Pt 1

- Harbor City Brewing Co., Full Tilt IPA - Surprisingly fresh, very drinkable, with nice bitter after taste.

- Capital Brewery, Munich Dark - NOT, but home on my pallet.

- Central Waters Brewing Co., Mud Puppy Porter - Choc'o-lat-y!, great malty after taste.

Challenge your self - Hopefully by now you are thinking this all seems possible. I can do this. If so, then maybe your astronomical world can open up to these intriguing challenge objects.

Catalog No.	Mag	Size	Coordinates - RA/Dec	Common Name	Remarks
NGC 6210	**8.8**	**16"**	**16h44.5m/+23^49'**	**Turtle Nebula**	**It's Green!**

Yea, it's small, but it is relatively bright. The fact that it's green makes it a standout on the star field and easy to find at lower power.

NGC 6369	**11.4**	**38"**	**17h29.3m/-23^46'**	**Little Ghost Nebula**	**Easy**

This one is faint, but easily located because it is amongst the three naked eye stars 51, 44, and 42 Ophiuchus. This small star asterism is located between the tea pot of Sagittarius and Antares in Scorpius. It was an easy target in the Club's Cave 8 inch f6 scope. This one will give you the confidence to seek out other fainter planetaries.

NGC 7293	**7.3**	**16'x12'**	**22h29.6m/-20^48'**	**Helix Nebula**	**BIG, 300 Lt Yrs**

How did this massive object qualify as a challenge object? True this object is big and has a bright magnitude, but the Helix Nebula has low surface brightness and located in a southern nondescript area of the sky. Just locating this object will improve your star hopping ability. It is much easier to observe at a dark sky site than it is at Peach Mountain.

NGC 6445	**11.2**	**33"**	**17h49.3m/-20^01'**		

Now it gets a little more difficult, but we will be rewarded for our efforts. This object shares a low power field with the 9th magnitude Globular Cluster NGC 6440. It is quite a pretty sight. I encourage you to check this one out.

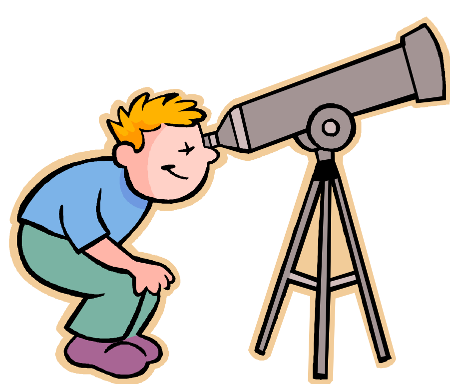
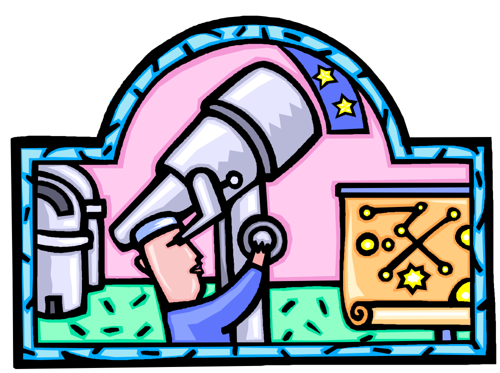
IC 1295	**12.5**	**1.7'x1.4'**	**18h54.6m/-08^50'**		

Save this one for a dark site such as Lake Hudson or Black Forest. This planetary also shares a low power field with a Globular Cluster. NGC 6712 is an 8.1 magnitude object that sits about two degrees east northeast of the open star cluster M 26. I have tried a couple of times to see this faint and large planetary at Peach Mountain, but didn't really see it until looking for it at Lake Hudson. The key to finding this planetary is to know where to look. Check out the fine article by Sue French in the August 2005 issue of *Sky & Telescope* about this planetary nebula and where to look for it.

What to Look For - When looking for planetary nebulae in the low power field of your telescope, remember these objects look like out of focus stars with greenish-bluish disks for the brighter ones. Higher magnification turns these fuzzy looking stars in to resolvable disks. Observing some planetaries will reveal the white dwarf central star. Some nebulae look like mini versions for the famous Ring Nebula, M57. Some even have discernable shapes beyond the usual circular disk. The Saturn Nebula, NGC 7009 has an oblong shape that resembles a low power view of the planet Saturn.

A technique to help locate smaller planetary discs from their stellar neighbors is to hold an Oxygen III filter up to the eyepiece. Planetary nebulae respond well to OIII filters while many of the fainter stars will drop out of the view. In my experience the OIII filter overpowers some the fainter features of the nebula. So I typically will not screw the filter into the eyepiece, but hold it over the eyepiece. Once I find the nebula in question, I put the OIII filter down and enjoy the view without it.

Once you master the bigger and brighter planetaries listed in this article, you should have the confidence to start looking for those "pesky smallish orbs" that you use to avoid. Small planetaries will require more magnification, but you will be rewarded with finding objects that you use to pass by. Let me know how your planetary observing runs go next time you see me on the "Hill". I'll be the guy chasing down yet another planetary. [OBTW - Don't forget to note the magnitude and size.]

The proud papa—Doug Scobel and his13" reflector

Doug's Deep Sky Challenge

by Doug Scobel

Astronomical Companions

No, I'm not talking about your buddies who keep you company during observing sessions at remote dark sky sites. Nor am I talking about your favorite stuffed animal (OK ladies, no wisecracks about your husbands!) that you like to take along with you along with the rest of your observing gear. Not even those pesky mosquitoes that seem to think of insect repellent as dessert. No, I'm talking about companion galaxies, and there are more out there within relatively easy reach of amateur sized telescopes than you may realize.

So what is a companion galaxy anyway? Large spiral galaxies are often accompanied by one or more smaller galaxies which are apparently gravitationally bound to the parent. These companions are most often small ellipticals or irregulars. For example, our own Milky Way hosts two notable companions, the Large and Small Megellanic Clouds, visible from more southern latitudes. Our home galaxy also hosts the Sagittarius Dwarf, which was only recently discovered because it lies beyond the obscuring dust near the Milky Way's central bulge.

What I thought I'd do here is list a few more or less easily viewed galaxies and their companions. There may be other examples, but these are ones that I've observed myself. In all cases visual (not photographic) magnitudes are quoted.

M51 - Possibly the most famous example of companion galaxies is the Whirlpool Galaxy, AKA Messier 51, and its companion **NGC 5195**. NGC 5195, at magnitude 9.6, is easily seen just a few arc minutes to the north of its spectacular face-on spiral parent. It is bright enough to be seen in my 8x50 finder scope from a dark site. It measures about 6 by 5 arc minutes, and appears to be connected to M51 by a "bridge". NGC 5195 has a high enough surface brightness that in larger scopes, say 25 cm (10 inches) and larger, you can see some detail in it at higher magnifications, although many observers don't look at it very closely due to the more fascinating spiral arms in the main galaxy. Were it not for its glamorous neighbor, it would be a fine target on its own. This pair of galaxies lies in the constellation Canes Venatici, near the end of the handle of the Big Dipper.

M31 - Next on our list is the great galaxy in Andromeda, Messier 31. Most observers know about its two closest companions, **M32** and **M110**, which are usually visited as a side trip when observing their show-off parent. M32, or **NGC 221**, is an elliptical galaxy that shines at magnitude 8.1. Measuring about 9 by 7 arc minutes, it has a high enough surface brightness that it can be seen in virtually any size telescope, given dark enough skies. At higher magnifications in larger apertures, M32 exhibits a very bright and concentrated almost star-like core. M110, or **NGC 205**, also at magnitude 8.1, is about double the dimensions of M32, and so has a much fainter surface brightness. In smaller apertures under poor skies it can sometimes be a challenge to find. It is also an elliptical, as are most companion galaxies, and does not show a lot of detail, other than a gradually brighter center.

But did you know that M31 also has two other companions that are within the reach of many telescopes? **NGC 147**, measuring about 14 by 8 arc minutes, and glowing at magnitude 9.5, has a very low surface brightness. **NGC 185**, at magnitude 9.2, and with dimensions of around 13 by 10 arc minutes, has a surface brightness only marginally better than NGC 147. You'll need a fair amount of aperture and more importantly a dark sky to pluck these two out of the background. And don't expect to see much if any detail in them either – you'll do well just to see them. NGCs 147 and 185 lie about seven degrees to the north, so most observers don't realize that they are gravitationally bound companions to M31. In fact, they're not even in the same constellation, but actually lie within Cassiopeia.

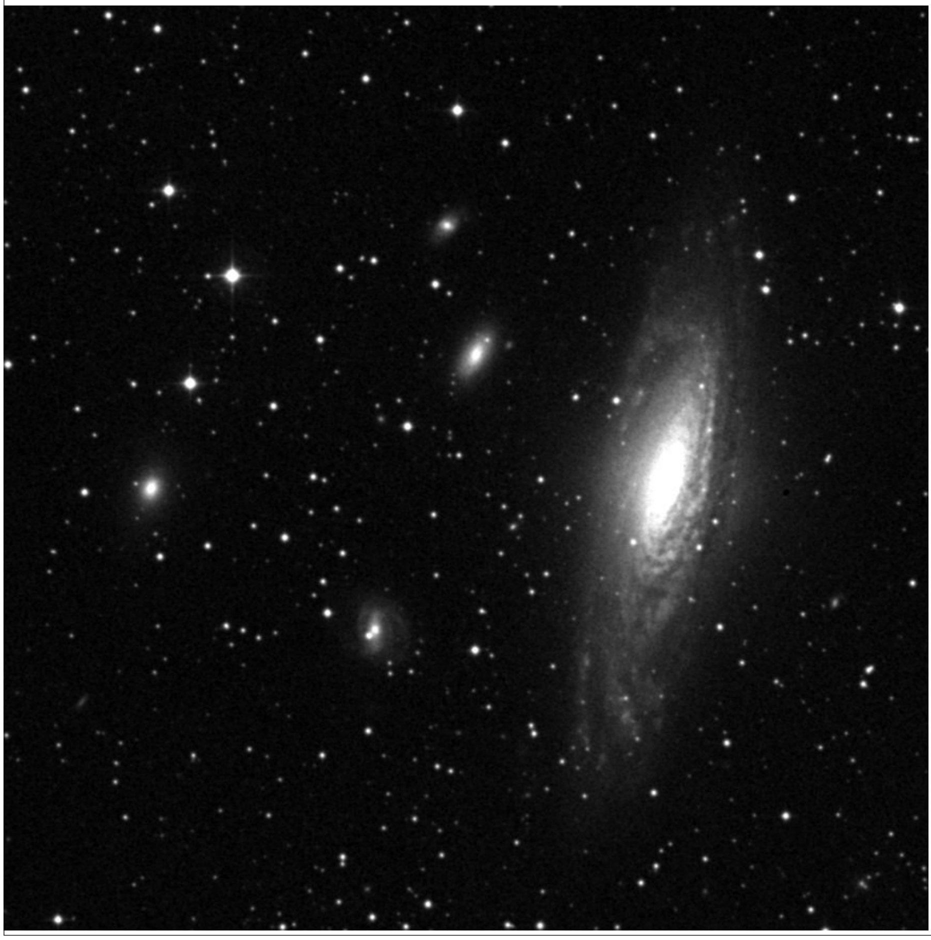
NGC 7331 - By far, the spiral galaxy NGC 7331, in the constellation Pegasus, is not nearly as famous as M51 or M31, but it is still worth checking out. It's not real spectacular; shining at magnitude 9.5 I find that in my 13-inch reflector it resembles the view of M31 in 35 or 50 mm binoculars. What makes it interesting is its four companion galaxies that lie less than 10 arc minutes away from it - all five can fit within the same medium-high power field of view. Unfortunately, none of the companions are very bright, so you'll need plenty of aperture, say 30 cm (12 inches) or more, good optics, and dark skies, just to see three of the four. They are all quite small, about an arc minute or less along their largest dimension, so you'll also have to use plenty of magnification to make them big enough to pick out from the background.

At magnitude 13.4, **NGC 7335** is the brightest of the group. It lies just a few arc minutes to the northeast of NGC 7331's core. It appears as an elongated patch with a brighter core. **NGC 7340** lies maybe 10 arc minutes nearly due east of its parent's core. Softly glowing at magnitude 13.7, its appearance is very similar to that of NGC 7335. By far, **NGC 7337,** at magnitude 14.4, is more challenging to spot. It showed up as just a smudge in my 13-inch reflector. It lies about five arc minutes to the southeast of NGC 7331's core. Finally, **NGC 7336**, at magnitude 15.0, will elude all but the largest of amateur telescopes. It has about half the dimensions of NGC 7335 and lies another couple arc minutes northeast. I would think that NGC 7336 should be visible in a 40 cm (16-inch) or larger scope, given dark enough observing conditions. I've never picked it up in my 13-inch, but I'm not done trying!

Here's a table with more information on the galaxies I described above:

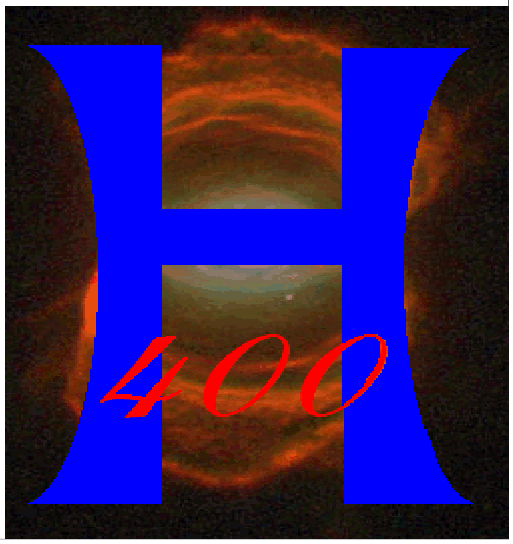
Name	Right Ascension	Declination	Magnitude	Dimensions	Position Angle	Surface Brightness (magnitudes per square arc minute)
M51 (NGC 5194)	13h29m	47^11'	8.4	10.8' x 6.6'	163	12.9
NGC 5195	13h30m	47^15'	9.6	5.9' x 4.6'	79	12.9
M31 (NGC 224)	0h42m	41^15'	3.4	189.1' x 61.7'	35	13.5
M32 (NGC 221)	0h42m	40^51'	8.1	8.5' x 6.5'	170	12.4
M110 (NGC 205)	0h40m	41^40'	8.1	19.5' x 11.5'	170	14.0
NGC 147	0h33m	48^29'	9.5	13.5' x 8.2'	25	14.5
NGC 185	0h38m	48^19'	9.2	12.5' x 10.4'	35	14.3
NGC 7331	22h37m	34^24'	9.5	10.2' x 4.2'	171	13.3
NGC 7335	22h37m	34^26'	13.4	1.3' x 0.6'	151	12.9
NGC 7336	22h37m	34^29'	15.0	0.4' x 0.3'	135	?
NGC 7337	22h37m	34^21'	14.4	1' x 0.8'	?	14.3
NGC 7340	22h37m	34^24'	13.7	0.9' x 0.6'	160	12.9

As you can now see there's nothing like a good companion or two while observing, so give these a try. If you know of others please let me know about them. I'd like to know – what do *you* see?



NGC 7331 and environs—image is from the Digital Sky Survey (DSS). Also visible in this image is NGC 7335, NGC 7336, NGC 7337 and NGC 7340 all of which are described wonderfully by Doug Scobel.

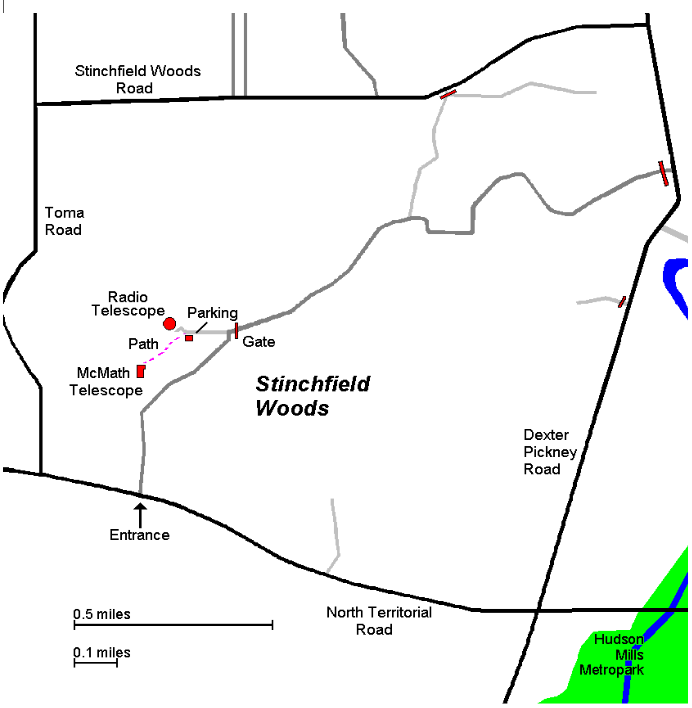
Doug is a highly accomplished observer, who has an uncanny knack for finding very faint objects. Doug has observed and catalog the "The Herschel 400" was recognized and awarded by the Astronomical League and is currently working "The Herschel II" list of faint fuzzies and at the rate he is going someone will have to create a "Herschel III" list.



Places & Times

Dennison Hall, also known as The University of Michigan's Physics & Astronomy building, is the site of the monthly meeting of the University Lowbrow Astronomers. Dennison Hall can be found on Church Street about one block north of South University Avenue in Ann Arbor, MI. The meetings are usually held in room 130, and on the 3rd Friday of each month at 7:30 pm. During the summer months and when weather permits, a club observing session at the Peach Mountain Observatory will follow the meeting.

Peach Mountain Observatory is the home of the University of Michigan's 25 meter radio telescope as well as the University's McMath 24" telescope which is maintained and operated by the Lowbrows. The observatory is located northwest of Dexter, MI; the entrance is on North Territorial Rd. 1.1 miles west of Dexter-Pinckney Rd. A small maize & blue sign on the north side of the road marks the gate. Follow the gravel road to the top of the hill and a parking area near the radio telescopes, then walk along the path between the two fenced in areas (about 300 feet) to reach the McMath telescope building.



Public Open House / Star Parties

Public Open Houses / Star Parties are generally held on the Saturdays before and after the New Moon at the Peach Mountain observatory, but are usually cancelled if the sky is cloudy at sunset or the temperature is below 10 degrees F. For the most up to date info on the Open House / Star Party status call: (734)332-9132. Many members bring their telescope to share with the public and visitors are welcome to do the same. Peach Mountain is home to millions of hungry mosquitoes, so apply bug repellent, and it can get rather cold at night, please dress accordingly.

Membership

Membership dues in the University Lowbrow Astronomers are $20 per year for individuals or families, and $12 per year for students and seniors (age 55/+). This entitles you to the monthly Newsletter and use of the 24" McMath telescope (after some training). Dues can be paid at the monthly meetings or by check made out to University Lowbrow Astronomers and mail to:

The University Lowbrow Astronomer c/o Kathy Hillig

7654 W. Ellsworth Road
Ann Arbor, MI 48103

Membership in the Lowbrows can also get you a discount on these magazine subscriptions:

Sky & Telescope - $32.95 / year

Astronomy - $29.00 / year

For more information contact the club Treasurer. Members renewing their subscriptions are reminded to provide the renewal notice along with your check to the club Treasurer. Please make your check out to: "University Lowbrow Astronomers"

Newsletter Contributions

Members and (non-members) are encouraged to write about any astronomy related topic of interest. Call or Email the Newsletter Editor: **Mark S Deprest (734)223-0262 or** msdeprest@comcast.net to discuss length and format. Announcements, articles and images are due by the 1st day of the month as publication is the 7th.

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photo by Yasuharu Inugi

Jim Forrester, Nathan Murphy, and Yasuharu Inugi *"phreezin' phor phaint phuzzy photons"* at Leslie Park in northeast Ann Arbor, MI. Leslie Park is one of the favored week-night spots that the *"Any Clear Night Observers"* (ACNO) group use for a quick night of observing. The ACNO group is kind of a sub-group of the Lowbrows that like to do Astronomy at a moments' notice. If you'd like to be part of this group send an e-mail to: msdeprest@comcast.net

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